

Turning points in information technology

by I. Wladawsky-Berger

Historically, the driving force behind the adoption of any technology has been its potential for transforming the way we live and work. Nowhere has that been more evident than in the progress of computer technology, and particularly in IBM's contributions through the years. A selection of papers representing those contributions is presented in this retrospective issue, providing examples of turning points documented by the *IBM Systems Journal* since 1962.

In the early years, OS/360 gave customers of IBM the ability to write applications and run them on a consistent operating system, making genuine business computing available for the first time. IBM made history by automating the back offices of *Fortune* 500 companies. All those humdrum basic business applications like payroll and BICARSA—billing inventory control, accounts receivable, and sales analysis—could now be carried on more efficiently, accurately, and quickly than in the old manual mode.

In the 1970s, IBM married data to networks, uniting information technology (IT) with communications, and created major products such as CICS* (Customer Information Control System), IMS* (Information Management System), and SNA (Systems Network Architecture) that brought on the age of real-time transaction processing. This further transformed business by basing relationships with customers on “live” information. An airline could make, change, and confirm bookings at a moment's notice. A bank teller could instantly inform a customer about an account balance and, eventually, with the development of the automatic teller machine, the relationship between bank and customer would become automated and immediate.

Business has never lived within the “brick and mortar” confines of the enterprise, but in the whole web of relationships among employees, customers, business partners, suppliers, shareholders—all those on whom the enterprise relies for success. Yet in the heterogeneous environment that evolved through the years from competing architectures and operating systems, these relationships were unreachable by IT in any integrated sense, dooming business to fragmented, discontinuous implementations that resulted in isolated “islands of automation.”

Not surprisingly, a vision was forming of IT's larger role in business. As developments furthered the progress of IT and its use in business, various individuals and groups contributed ideas and expertise. To their credit and our benefit, these men and women were trying to define a role beyond individual products—to provide an architectural context for the systematic integration of IT into business and a conceptual framework for thinking about the business itself. In reaching the current state of IT, some of the developments influenced past progress to such a degree that they are considered to be turning points.

In this section of this issue, several reprinted papers describing some of these turning points are included as representative selections of IT topics that were published in the *IBM Systems Journal*. As the author of the first of these papers, which is entitled “A Framework for Information Systems Architecture,” J. A. Zachman is well known for the architectural framework that helps to place business elements in a structure that

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organizes information to better utilize IT. In the second paper, "Strategic Alignment: Leveraging Information Technology for Transforming Organizations," J. C. Henderson and N. Venkatraman explain how the goals of a business can be aligned with IT so that the operation of the business is more productive. W. H. Davidson carries this idea further, showing how IT can be used to completely transform a business, in "Beyond Re-engineering: The Three Phases of Business Transformation," also reprinted here. In addition to the papers appearing here, a selection of related papers is presented in the bibliography.

The formation of the vision of IT's larger role, though compelling, would remain Utopian in the absence of standards-based technologies. Meanwhile in the university and research community, the Internet had been germinating out of public sight since 1969. Not long after development of the World Wide Web in 1991 and later Mosaic, the first graphical user interface for the Web, business began to see the Internet's technologies and standards as a way to connect all the information systems in which it had invested (by some estimates more than \$1 trillion) over the years.

Businesses began integrating Web standards and technologies into their existing information technology. In the process, a new, extended IT infrastructure emerged along with a new e-business model based on the ability to reach anyone inside or outside a company any time of the day or night. The transformation to e-business has been dramatic and continuing. An example of this progression is the recently published paper by Abad Peiro et al.¹ that appeared in Volume 37, Number 1, 1998, of the *IBM Systems Journal*. That entire issue as well as Volume 37, Number 3, 1998, focus on computing on the Internet and on related technologies.

As the use of IT becomes even more important to business, the nature of work and commerce is changing. These changes are now described, and some of the directions in which developments in computing are leading business are presented.

Changing the nature of work

The innovative use of Web standards and technologies enables thousands of businesses to establish intranets linking geographically dispersed workers and information within an enterprise. Lockheed Martin Corporation and The Boeing Company, collaborating over an intranet, developed the Darkstar aircraft in 11 months with 50 people, a process usually requiring hundreds of designers and years of work.

In turn, intranets are being linked to extranets connecting a firm to all its trading partners. These internal and external links are delivering what was thought impossible a short time ago: efficient, timely collaboration within the enterprise and between firms separated from each other by thousands of miles and many time zones. For the first time, a worldwide enterprise, and its trading partners, can act as a unified, global team, because workers can leverage a shared base of knowledge delivered from anywhere.

A combination of intranets and extranets enables ABB, the Swiss transnational, to integrate over 60 000 users in a worldwide corporate network spanning more than 80 countries and to connect over 100 external companies—both customers and business partners. IBM increasingly relates to the world through its external Web site. Meanwhile, its internal site is a source for all of its employees on everything from strategy to the Tax Deferred Savings Plan (401K plan).

Changing the nature of commerce

The global reach of heretofore local companies may startle some firms that thought they were established in their markets. Likewise, Web-based networks are permitting new competitors with very clearly focused core competencies to enter established industries and then develop on-line partnerships to complement their operations. Moreover, with the use of the Web, power is migrating to the buyer who, armed with all sorts of information on price, quality, and availability, can now easily compare a global universe of suppliers.

Among all the Web-generated changes in commerce, however, the most exciting is the growing degree of personalization facilitated by this new medium. In the past, business focused on the product, designing it

to appeal to a mass market. Now with the colossal amounts of information and processing power available to an e-business, suppliers can gain a far more comprehensive knowledge of their customers and focus on them as individuals. Instead of ending after the transaction, the relationship with the customer can span an entire lifetime because e-business technologies can build a corporate memory of each person's needs and wants. With growing personalization, suppliers are beginning to differentiate their brands as much on knowledge of the customer as on price and quality.

The next generation e-business

No end to the e-business transformation appears to be in sight, as many powerful forces conspire to drive it forward.

- Driven by the imperatives of electronic commerce, companies are automating and integrating all their business processes from the customer at one end to all their suppliers at the other. In this e-commerce environment, one transaction (one click) by a customer will trigger multiple transactions throughout the enterprise. As a consequence, the next generation of transaction processing built on incredibly scalable, reliable, manageable, and secure hardware and software servers is emerging before our eyes.
- Knowledge management technologies are beginning to bring employees together across time and space, making them more effective, responsive, and innovative.² Knowledge management is already making distributed learning a reality, and soon synchronous communications will make real-time video collaboration available for education, training, and general e-business communication.
- Deep computing, directly descended from Deep Blue*, an IBM supercomputer noted for its chess-playing ability, is already being used to transform information into useful, valuable knowledge. It is being employed by customers as diverse as the San Diego Supercomputing Laboratory and *The New York Times*, in the first case to support researchers from all over the world and in the latter to target advertising to precisely the right people.
- Pervasive computing is in the process of "Web-enabling" everybody and everything that can benefit from information technology. Everything from our cars to our washing machines may be connected to the Web and automated to one degree or another.
- Digital media, such as IBM's HotMedia, will enrich the Web experience with video, sound, graphics, animation, and all sorts of effects. As a result, the Web will begin to reach more and more people because it will approach us on our own terms, that is to say, through our eyes and ears.
- Undergirding all this will be a renewed Internet infrastructure, phenomenally reliable and secure, a hundred to a thousand times faster than the Internet today, and providing the most sophisticated applications imaginable.

In fact, e-business technologies and techniques will become so thoroughly integrated into our lives that more than business will be transformed. Society in general and our day-to-day lives will be automated to a degree undreamed of in the past. Still, we would all do well to bear in mind one critical principle: In a business (or in life for that matter), few are enthralled by the prospect of being surrounded by technology; what does thrill us is the potential for transformation.

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